NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

RIPARIAN FOREST BUFFER

(Acre)

CODE 391

DEFINITION

An area of predominantly trees and/or shrubs located adjacent to and up-gradient from watercourses or water bodies.

PURPOSES

- Create shade to lower water temperatures to improve habitat for aquatic organisms.
- Provide a source of detritus and large woody debris for aquatic and terrestrial organisms.
- Create wildlife habitat and establish wildlife corridors.
- Reduce excess amounts of sediment, organic material, nutrients, and pesticides in surface runoff and reduce excess nutrients and other chemicals in shallow ground water flow.
- Provide a harvestable crop of timber, fiber, forage, fruit, or other crops consistent with other intended purposes.
- Provide protection against scour erosion within the floodplain.
- Restore natural riparian plant communities.
- Moderate winter temperatures to reduce freezing of aquatic over-wintering habitats.
- To increase carbon storage.

CONDITIONS WHERE PRACTICE APPLIES

On areas adjacent to permanent or intermittent streams, lakes, ponds, wetlands and areas with ground water recharge that are capable of supporting woody vegetation.

CRITERIA

General Criteria Applicable to all Purposes

The location, layout and density of the riparian forest buffer will accomplish the intended purpose and function.

Dominant vegetation will consist of existing, naturally regenerated, or planted trees and shrubs suited to the site and the intended purpose.

All buffers will consist of a Zone 1 that begins at the normal water line, or at the top of the bank, and extends a minimum distance of 15 feet, measured horizontally on a line perpendicular to the water body.

Occasional removal of some tree and shrub products such as high value trees is permitted in zone 1 provided the intended purpose is not compromised by the loss of vegetation or harvesting disturbance.

Necessary site preparation and planting shall be done at a time and manner to insure survival and growth of selected species.

Only viable, high-quality and adapted planting stock will be used.

Site preparation shall be sufficient for establishment and growth of selected species and is done in a manner that does not compromise the intended purpose.

Livestock shall be controlled or excluded as necessary to achieve and maintain the intended purpose.

Harmful pests present on the site will be controlled or eliminated as necessary to achieve and maintain the intended purpose.

For optimal carbon storage, select plant species that are adapted to the site to assure strong health and vigor and plant the full stocking rate for the site.

Comply with applicable federal, state and local laws and regulations during the installation, operation (including harvesting activities), and maintenance of this practice.

Additional Criteria to Reduce Excess Amounts of Sediment, Organic Material, Nutrients, and Pesticides in Surface Runoff and Reduce Excess Nutrients and Other Chemicals in Shallow Ground Water Flow

An additional strip or area of land, Zone 2, will begin at the edge and up-gradient of Zone 1 and extend a minimum distance of 20 feet, measured horizontally on a line perpendicular to the water body. The minimum combined width of Zones 1 and 2 will be 100 feet or 30 percent of the floodplain, whichever is less, but not less than 35 feet.

Criteria for Zone 1 shall apply to Zone 2 except that removal of products such as timber, fiber**,** nuts, fruit and forbs is permitted and encouraged on a periodic and regular basis provided the intended purpose is not compromised by loss of vegetation or harvesting disturbance.

Zone 2 will be expanded in high nutrient, sediment, and animal waste application areas, where the contributing area is not adequately treated or where an additional level of protection is desired.

A Zone 3 shall be added to the riparian buffer to address concentrated flow erosion and maintain sheet flow. The Filter Strip standard (practice code 393) shall be used to design Zone 3.

Additional Criteria to Provide Habitat for Aquatic Organisms and Terrestrial Wildlife

Width of Zone 1 and/or Zone 2 will be expanded to meet the minimum requirements of the wildlife or aquatic species and associated communities of concern.

Establish plant communities that address the target wildlife needs and existing resources in the watershed.

CONSIDERATIONS

The severity of bank erosion, concentrated flow erosion, or mass soil movement and its influence on existing or potential riparian trees and shrubs should be assessed. Watershed level or contributing area treatment or bank stability activities may be needed before establishing a riparian forest buffer.

When concentrated flow erosion and sedimentation cannot be controlled with

vegetation, consider structural or mechanical treatments.

Favor tree and shrub species that are native**,** non-invasive, or have multiple values such as those suited for timber, biomass, nuts, fruit, browse, nesting, aesthetics and tolerance to locally used herbicides.

Tree and shrub species that may be alternate hosts to undesirable pests should be avoided. Species diversity should be considered to avoid loss of function due to species-specific pests.

Plants that deplete ground water should be used with caution in water-deficit areas.

Allelopathic impacts of plants should be considered.

The location, layout, and density of the buffer should complement natural features, and mimic natural riparian forests.

PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets, technical notes, and narrative statements in the conservation plan, or other acceptable documentation.

Procedures, technical details, and other information listed below provide additional guidance for carrying out selected components of the named practice. This material is referenced from the conservation practice standard for the named practice and supplements the requirements and considerations listed therein.

BUFFER WIDTH GUIDE FOR SELECTED BENEFITS

The following chart should be used in planning planning the minimum horizontal buffer width beginning for the water line.

Purpose	Minimum Buffer Width (Feet)
Sediment Filtering	35
Aquatic Habitat Protection	40
Soluble Nutrients Removal	50

The buffer widths listed below benefit the targeted wildlife, and include the sum of the buffer on one or both sides of the water body, and may extend beyond the riparian boundary.

Targeted Species	Minimum Buffer Width (Feet)
Amphibians	100
Deer	200
Small Mammals	300
Cavity Nesting Ducks	600

PLANT LIST

Table 1 lists woody plant species (trees and shrubs) commonly associated with riparian areas and suitable for establishment. Key attributes are listed for each plant to assist in designing a buffer that can achieve the planned purposes and in selecting the proper species for the site. This list is not all inclusive, and other species may be used if suited to the site and complementary to the intended purpose of the riparian area.

PLANTING DENSITIES

Initial spacing between plants will depend on the primary benefits the planting is designed to achieve. Table 1 lists the recommended seedling planting spacing for the commonly desired buffer benefits. Tree rows should be parallel to the stream or water body and on the contour as nearly as possible.

CARE, HANDLING, SIZE, AND PLANTING REQUIREMENTS FOR WOODY PLANTING STOCK

NRCS Tree and Shrub Establishment Practice Standard (Code 612) shall be followed when using woody planting stock.

OPERATION AND MAINTENANCE

The following actions shall be carried out to ensure that this practice functions as intended throughout its expected life.

The riparian forest buffer will be inspected periodically and protected from adverse impacts such as excessive vehicular and pedestrian traffic, pest infestations, pesticides, livestock or wildlife damage, and fire.

Replacement of dead trees or shrubs and control of undesirable vegetative competition will be continued until the buffer is, or will progress to, a fully functional condition.

As applicable, control of concentrated flow erosion and sediment deposition shall be controlled by an adjacent filter strip.

Any use of fertilizers, pesticides, and other chemicals to assure buffer function shall not compromise the intended purpose.

REFERENCES

Society of American Foresters. Forestry Handbook, Second Edition. 1984.

USDA Forest Service. 1991. Riparian Forest Buffers - Function and Design - for Protection and Enhancement of Water Resources. NA-PR-07-91.

NRCS, TN
May 22, 2008

TABLE 1 - WOODY PLANTS FOR RIPARIAN AREAS

PLANT COMMON/SCIENTIFIC NAME	ATTRIBUTES		PLANTS/ACRE (SPACING-Feet)	
	FLOOD TOLERANCE	BENEFITS	MINIMUM	MAXIMUM
EVERGREEN TREES				
Loblolly Pine - Pinus taeda	M	A T	436 (10x10)	681 (8x8)
Shortleaf Pine - Pinus echinata	M	A T	436 (10x10)	681 (8x8)
Virginia Pine - Pinus virginiana	M	A T	436 (10x10)	681 (8x8)
White Pine - Pinus strobus	M	A T	436 (10x10)	681 (8x8)
Eastern Hemlock - Tsuga canadensis	M	A B T	436 (10x10)	681 (8x8)
DECIDUOUS TREES				
Baldcypress - Taxodium distichum	VH	A B T	436 (10x10)	681 (8x8)
Black Willow - Salix nigra	VH	A	436 (10x10)	681 (8x8)
Eastern Cottonwood - Populus deltoides	VH	A T	302 (12x12)	436 (10x10)
Green Ash - Fraxinus pennsylvanica	VH	A T W	302 (12x12)	436 (10x10)
Swamp White Oak - Quercus bicolor	VH	A T W	302 (12x12)	436 (10x10)
Sycamore - Platanus occidentalis	VH	A T	302 (12x12)	436 (10x10)
Water Tupelo - Nyssa aquatica	VH	A B T W	302 (12x12)	436 (10x10)
Blackgum - Nyssa sylvatica	H	A B T W	302 (12x12)	436 (10x10)
Cherrybark Oak - Quercus falcata v. pag.	H	A B T W	302 (12x12)	436 (10x10)
Nuttall Oak - Quercus nutallii	H	A T W	302 (12x12)	436 (10x10)
Persimmon - Diospyros virginiana	H	T W	302 (12x12)	436 (10x10)
Pin Oak - Quercus palustris	H	A B W T	302 (12x12)	436 (10x10)
Red Maple - Acer rubrum	H	A B W T	302 (12x12)	436 (10x10)
River Birch - Betula nigra	H	A B	436 (10x10)	681 (8x8)
Silver Maple - Acer saccharinum	H	A W	436 (10x10)	681 (8x8)
Swamp Chestnut Oak - Quercus michauxii	H	A T W	302 (12x12)	436 (10x10)
Sweetgum - Liquidambar stryaciflua	H	A B T	302 (12x12)	436 (10x10)
Water Oak - Quercus nigra	H	A T W	302 (12x12)	436 (10x10)
White Ash - Fraxinus americana	H	A T W	302 (12x12)	436 (10x10)
Willow Oak - Quercus phellos	H	A B T W	302 (12x12)	436 (10x10)
Black Walnut - Juglans nigra	M	T W	302 (12x12)	436 (10x10)
Hickory - Carya spp.	M	T W	302 (12x12)	436 (10x10)
Northern Red Oak - Quercus rubra	M	A B T W	302 (12x12)	436 (10x10)
Royal Paulownia - Paulownia tomentosa	M	B T	302 (12x12)	436 (10x10)
Sawtooth Oak - Quercus accutissma	M	B W	436 (10x10)	681 (8x8)
Shumard Oak - Quercus shumardii	M	A B T W	302 (12x12)	436 (10x10)
Southern Red Oak - Quercus falcata	M	A B T W	302 (12x12)	436 (10x10)
Sugar Maple - Acer saccharum	M	B T W	302 (12x12)	436 (10x10)
Yellow Poplar - Liriodendron tulipifera	M	B T W	302 (12x12)	436 (10x10)

FLOOD TOLERANCE: VH = VERY HIGH
H = HIGH
M = MODERATE

BENEFITS: A = AQUATIC
B = AESTHETIC
T = TIMBER
W = WILDLIFE

TABLE 1 - WOODY PLANTS FOR RIPARIAN AREAS (CONTINUED)

PLANT COMMON/SCIENTIFIC NAME	ATTRIBUTES		PLANTS/ACRE (SPACING-Feet)	
	FLOOD TOLERANCE	BENEFITS	MINIMUM	MAXIMUM
SHRUBS				
Bankers Willow - Saxlix banksiana	VH	A B	1,210 (6x6)	2,722 (4x4)
Boxelder - Acer negundo	H	A B W T	681 (8x8)	1,210 (6x6)
Smooth Alder - Alnus serrulata	H	A W	681 (8x8)	1,210 (6x6)
Black Alder - Alnus glutinosa	H	A W	681 (8x8)	1,210 (6x6)
Crabapple - Malus angustifolia	M	B W	681 (8x8)	1,210 (6x6)
Wild Apple - Malus coronaria	M	B W	681 (8x8)	1,210 (6x6)
Hawthorn - Crataegus spp.	M	B W	681 (8x8)	1,210 (6x6)
Chickasaw Plum - Prunus angustifolia	M	B W	681 (8x8)	1,210 (6x6)
Wild Plum - Prunus americana	M	B W	681 (8x8)	1,210 (6x6)
Chinese Chestnut - Castanea mollissima	M	B W	681 (8x8)	1,210 (6x6)
Indigobush - Amorpha fruticosa	M	B W	1,210 (6x6)	2,722 (4x4)
Flowering Dogwood - Cornus florida	M	B W	681 (8x8)	1,210 (6x6)
Gray Dogwood - Cornus racemosa	M	A B W	681 (8x8)	1,210 (6x6)
Roughleaf Dogwood - Cornus drummondi	M	A B W	681 (8x8)	1,210 (6x6)
Am. Beautyberry - Callicarpa Americana	M	A B W	1,210 (6x6)	2,722 (4x4)
Viburnum - Viburnum spp.	M	A B W	681 (8x8)	1,210 (6x6)
Wild Hydrangia - Hydrangia arborescens	M	A B W	1,210 (6x6)	2,722 (4x4)
Strawberry-bush - Euonymus americana	M	A B W	1,210 (6x6)	2,722 (4x4)

FLOOD TOLERANCE: VH = VERY HIGH
H = HIGH
M = MODERATE

BENEFITS: A = AQUATIC
B = AESTHETIC
T = TIMBER
W = WILDLIFE